

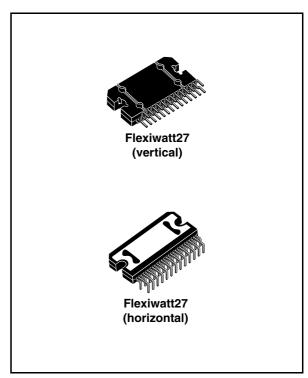
4 x 50 W MOSFET quad bridge power amplifier

Features

- High output power capability:
 - 4 x 50 W/4 Ω max.
 - 4 x 30 W/4 Ω @ 14.4 V, 1 kHz, 10 %
 - 4 x 80 W/2 Ω max.
 - 4 x 55 W/2 Ω @ 14.4 V, 1 kHz, 10 %
- MOSFET output power stage
- \blacksquare Excellent 2 Ω driving capability
- Hi-fi class distortion
- Low output noise
- Standby function
- Mute function
- Automute at min. supply voltage detection
- Low external component count:
 - Internally fixed gain (26 dB)
 - No external compensation
 - No bootstrap capacitors
- On board 0.35 A high side driver

Protections:

- Output short circuit to GND, to V_s, across the load
- Very inductive loads
- Overrating chip temperature with soft thermal limiter
- Output DC offset detection
- Load dump voltage
- Fortuitous open gnd
- Reversed battery



■ ESD

Description

The TDA7850A is a breakthrough MOSFET technology class AB audio power amplifier in Flexiwatt27 package designed for high power car radio. The fully complementary P-Channel/N-Channel output structure allows a rail to rail output voltage swing which, combined with high output current and minimized saturation losses sets new power references in the car-radio field, with unparalleled distortion performances.

The TDA7850A integrates a DC offset detector.

Table 1. Device summary

Order code	Package	Packing
TDA7850A	Flexiwatt27 (vertical)	Tube
TDA7850AH	Flexiwatt27 (horizontal	Tube

Contents TDA7850A

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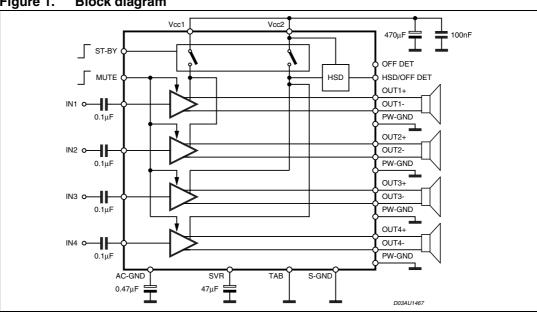
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Block diagram and application circuit 1

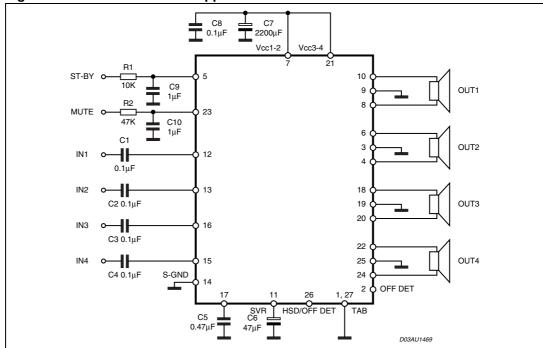
1.1 **Block diagram**

Figure 1. **Block diagram**



1.2 Standard test and application circuit

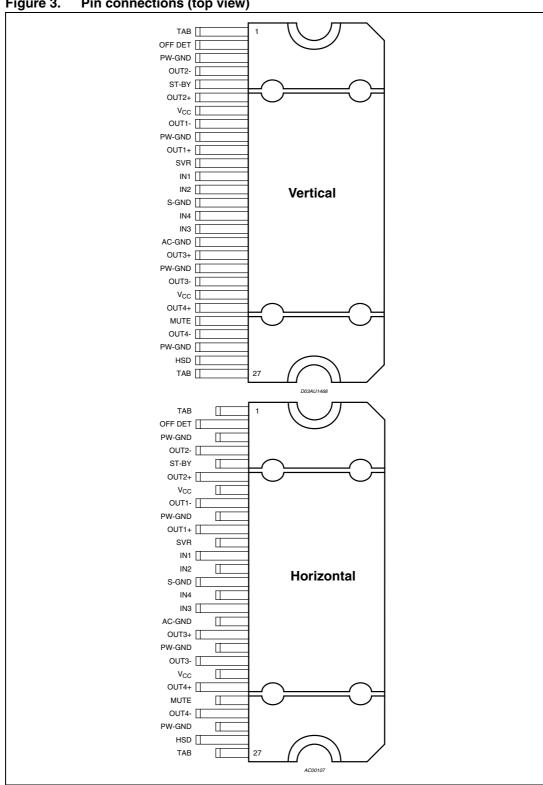
Figure 2. Standard test and application circuit



Pin description **TDA7850A**

2 Pin description





3 Electrical specifications

3.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V _S	Operating supply voltage	18	٧
V _{S (DC)}	DC supply voltage	28	V
V _{S (pk)}	Peak supply voltage (for t = 50 ms)	50	V
I _O	Output peak current repetitive (duty cycle 10 % at f = 10 Hz) non repetitive (t = 100 µs)	9 10	A A
P _{tot}	Power dissipation T _{case} = 70 °C	80	W
T _j	Junction temperature	150	°C
T _{stg}	Storage temperature	-55 to 150	°C

3.2 Thermal data

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R _{th j-case}	Thermal resistance junction to case Max.	1	°C/W

3.3 Electrical characteristics

Table 4. Electrical characteristics

(Refer to the test and application diagram, V_S = 14.4 V; R_L = 4 Ω ; R_g = 600 Ω ; f = 1 kHz; T_{amb} = 25 °C; unless otherwise specified).

Symbol	Parameter	Test condition	Min.	Тур.	Max.	Unit
I _{q1}	Quiescent current	$R_L = \infty$	100	180	280	mA
V _{OS}	Output offset voltage	Play mode - Mute mode			±50	mV
dV	During mute ON/OFF output offset voltage	ITU R-ARM weighted	-10		+10	mV
dV _{OS}	During St-By ON/OFF output offset voltage	see Figure 18	-10		+10	mV
G _v	Voltage gain		25	26	27	dB
dG _v	Channel gain unbalance				±1	dB

Table 4. Electrical characteristics (continued) (Refer to the test and application diagram, $V_S = 14.4 \text{ V}$; $R_L = 4 \Omega$; $R_g = 600 \Omega$; f = 1 kHz;

T_{amb} = 25 °C; unless otherwise specified). **Symbol Test condition** Max. Unit **Parameter** Min. Тур. V_S = 13.2 V; THD = 10 % 23 25 $V_S = 13.2 \text{ V}; \text{ THD} = 1 \%$ 16 19 W $V_S = 14.4 \text{ V}; \text{ THD} = 10 \%$ 28 30 P_o Output power V_S = 14.4 V; THD = 1 % 20 23 V_S = 14.4 V; THD = 10 %, 2 Ω 50 W 55 $V_S = 14.4 \text{ V}; R_L = 4 \Omega$ 50 Max. output power⁽¹⁾ W Po max. $V_S = 14.4 \text{ V}; R_L = 2 \Omega$ 85 $P_0 = 4 W$ 0.006 0.02 THD Distortion % $P_0 = 15 \text{ W}; R_L = 2 \Omega$ 0.015 0.03 "A" Weighted 50 35 Output noise μV e_{No} Bw = 20 Hz to 20 kHz70 50 **SVR** Supply voltage rejection $f = 100 \text{ Hz}; V_r = 1 \text{ Vrms}$ 50 dΒ 75 High cut-off frequency $P_0 = 0.5 \text{ W}$ 100 300 KHz f_{ch} 80 100 120 $\mathsf{K}\Omega$ R_i Input impedance f = 1 kHz; $P_0 = 4 \text{ W}$ 60 70 C_T Cross talk dΒ $f = 10 \text{ kHz}; P_0 = 4 \text{ W}$ 60 $V_{ST-BY} = 1.5 V$ 20 Standby current consumption μΑ I_{SB} $V_{ST-BY} = 0V$ 10 Standby pin current $V_{ST-BY} = 1.5V \text{ to } 3.5V$ ±1 μΑ I_{pin5} ٧ $V_{SB \ out}$ Standby out threshold voltage (Amp: ON) 2.75 V Standby in threshold voltage (Amp: OFF) $V_{SB\ in}$ 1.5 dΒ Mute attenuation $P_{Oref} = 4W$ 80 90 A_{M} ٧ Mute out threshold voltage $V_{M \ out}$ (Amp: Play) 3.5 (Amp: Mute) 1.5 ٧ $V_{M in}$ Mute in threshold voltage (Amp: Mute) Att \geq 80 dB; $P_{Oref} = 4 W$ 6.5 7 ٧ $V_{AM in}$ V_S automute threshold (Amp: Play) $Att < 0.1 dB; P_O = 0.5 W$ 7.5 $V_{MUTE} = 1.5 V$ 7 12 18 μА (Sourced Current) Muting pin current I_{pin23} $V_{MUTE} = 3.5 V$ -5 18 μΑ **HSD** section Dropout voltage $I_{O} = 0.35 \text{ A}; V_{S} = 9 \text{ to } 16 \text{ V}$ 0.25 ٧ $V_{dropout}$ **Current limits** 400 800 mΑ Iprot

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Table 4. Electrical characteristics (continued)

(Refer to the test and application diagram, V_S = 14.4 V; R_L = 4 Ω ; R_g = 600 Ω ; f = 1 kHz; T_{amb} = 25 °C; unless otherwise specified).

Symbol	Parameter	Test condition	Min.	Тур.	Max.	Unit
Offset de	tector (Pin 26)					
V_{M_ON}	Mute voltage for DC offset	V _{ST-BY} = 5 V	8			V
V_{M_OFF}	detection enabled	V _{ST-BY} = 5 V			6	V
V_{OFF}	Detected differential output offset	$V_{ST-BY} = 5 \text{ V}; V_{\text{mute}} = 8 \text{ V}$	±2	±3	±4	V
V _{26_T}	Pin 26 voltage for detection = TRUE	$V_{ST-BY} = 5 \text{ V}; V_{mute} = 8 \text{ V}$ $V_{OFF} > \pm 4 \text{ V}$	0		1.5	>
V _{26_F}	Pin 26 voltage for detection = FALSE	$V_{ST-BY} = 5 \text{ V}; V_{mute} = 8 \text{ V}$ $V_{OFF} > \pm 2 \text{ V}$	12			٧

^{1.} Saturated square wave output.

3.4 Electrical characteristic curves

Figure 4. Quiescent current vs. supply voltage

Figure 5. Output power vs. supply voltage $(R_L = 4 \Omega)$

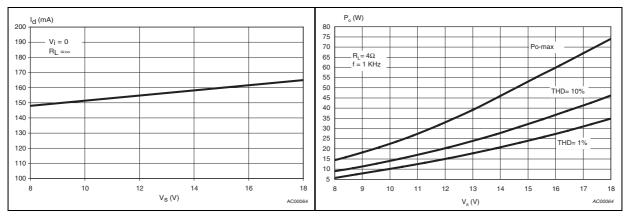


Figure 6. Output power vs. supply voltage ($R_L = 2 \Omega$)

Figure 7. Distortion vs. output power $(R_L = 4 \Omega)$

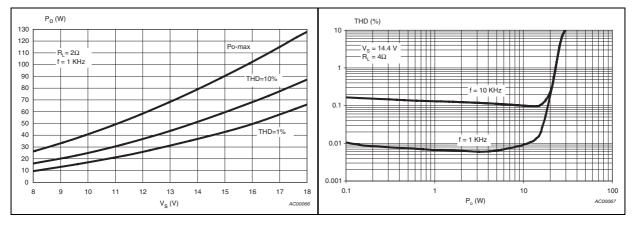


Figure 8. Distortion vs. output power $(R_L = 2 \Omega)$

Figure 9. Distortion vs. frequency $(R_L = 4 \Omega)$

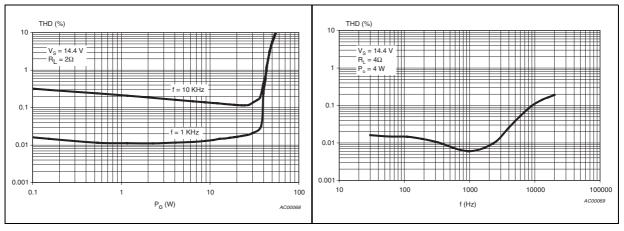


Figure 10. Distortion vs. frequency $(R_L = 2 \Omega)$

Figure 11. Crosstalk vs. frequency

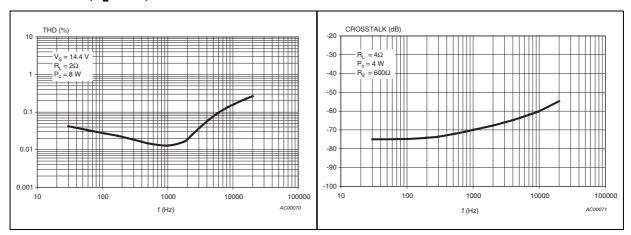


Figure 12. Supply voltage rejection vs. frequency

Figure 13. Output attenuation vs. supply voltage

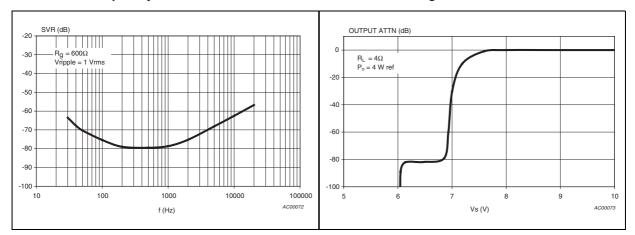
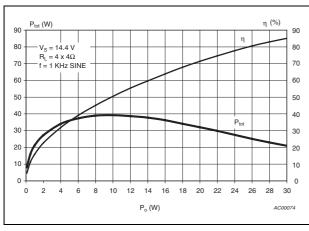


Figure 14. Power dissipation and efficiency vs. output power ($R_L = 4 \Omega$, SINE)

Figure 15. Power dissipation and efficiency vs. output power ($R_L = 2 \Omega$, SINE)



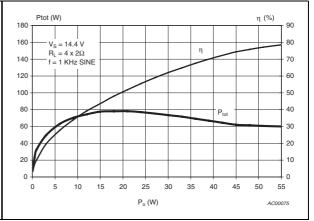
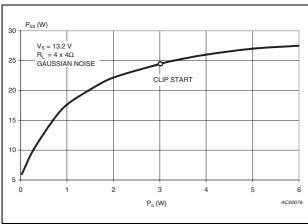


Figure 16. Power dissipation vs. output power Figure 17. Power dissipation vs. output power ($R_L = 4\Omega$, audio program simulation) ($R_L = 2\Omega$, audio program simulation)



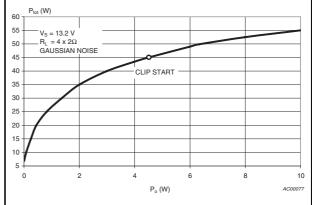
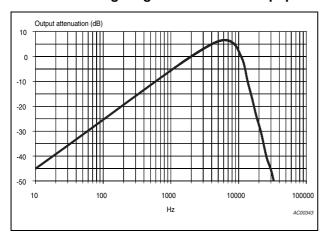


Figure 18. ITU R-ARM frequency response, weighting filter for transient pop



Application hints TDA7850A

4 Application hints

Ref. to the circuit of Figure 2.

4.1 SVR

Besides its contribution to the ripple rejection, the SVR capacitor governs the turn ON/OFF time sequence and, consequently, plays an essential role in the pop optimization during ON/OFF transients. To conveniently serve both needs, **Its minimum recommended value is 10µF**.

4.2 Input stage

The TDA7850A's inputs are ground-compatible and can stand very high input signals (± 8Vpk) without any performance degradation.

If the standard value for the input capacitors (0.1 μ F) is adopted, the low frequency cut-off will amount to 16 Hz.

4.3 Standby and muting

STANDBY and MUTING facilities are both CMOS compatible. In absence of true CMOS ports or microprocessors, a direct connection to Vs of these two pins is admissible but a $470 \mathrm{k}\Omega$ equivalent resistance should be present between the power supply and the muting and stand-by pins.

R-C cells have always to be used in order to smooth down the transitions for preventing any audible transient noises.

About the stand-by, the time constant to be assigned in order to obtain a virtually pop-free transition has to be slower than 2.5V/ms.

4.4 DC offset detector

The TDA7850A integrates a DC offset detector to avoid that an anomalous DC offset on the inputs of the amplifier may be multiplied by the gain and result in a dangerous large offset on the outputs which may lead to speakers damage for overheating.

The feature works with the amplifier unmuted and no signal at the inputs.

The DC offset detection can be available at 2 different pins:

- Pin 2 (always enabled)
- Pin 26. Only enabled if Vmute (pin23) is set higher than 8V. If not (Vmute < 6 V) pin 26 will revert to the original HSD function.

4.5 Heatsink definition

Under normal usage (4 Ohm speakers) the heatsink's thermal requirements have to be deduced from *Figure 16*, which reports the simulated power dissipation when real music/speech programmes are played out. Noise with gaussian-distributed amplitude was employed for this simulation. Based on that, frequent clipping occurrence (worst-case) will cause $P_{diss} = 26W$. Assuming $T_{amb} = 70^{\circ}C$ and $T_{CHIP} = 150^{\circ}C$ as boundary conditions, the heatsink's thermal resistance should be approximately $2^{\circ}C/W$. This would avoid any thermal shutdown occurrence even after long-term and full-volume operation.

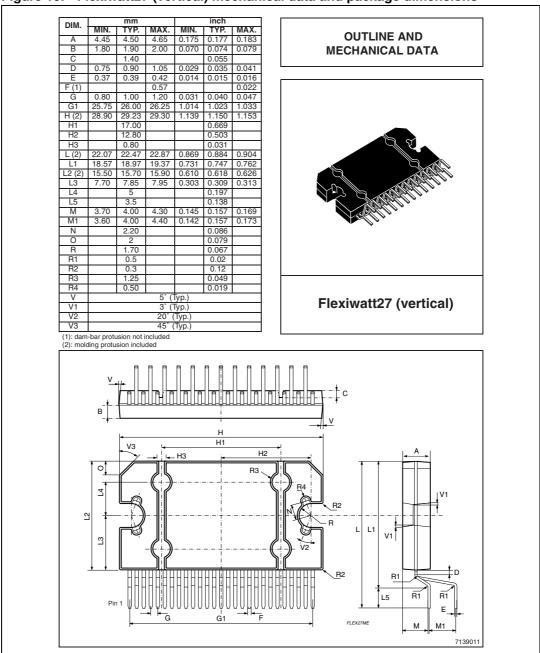
TDA7850A Package information

5 Package information

In order to meet environmental requirements, ST (also) offers these devices in ECOPACK[®] packages. ECOPACK[®] packages are lead-free. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label.

ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

Figure 19. Flexiwatt27 (vertical) mechanical data and package dimensions



Package information TDA7850A

Figure 20. Flexiwatt27 (horizontal) mechanical data and package dimensions

MIN. 17P. MAX. MIN. 17P. MAX. A 14.54 4.50 4.65 0.175 0.177 0.183 B 1.80 1.90 2.00 0.070 0.074 0.079 C 1.40 0.055 D 2.00 4.0 0.059 E 0.37 0.39 0.42 0.014 0.015 0.016 F(1) 0.57 0.09 0.62 5.1014 1.023 1.033 H (2) 28.90 2.92 3 29.3 1.139 1.150 1.153 H1 17.00 0.503 H2 12.80 0.0503 H3 0.80 0.051 1.99 1.150 1.153 H1 10.15 10.5 10.85 0.40 0.413 0.427 L(2) 21.64 22.04 22.44 0.852 0.868 0.883 L1 10.15 10.5 10.85 0.40 0.413 0.427 L2 (2) 15.55 15.70 15.90 0.610 0.618 0.628 L3 7.70 7.85 7.95 0.303 0.309 0.313 L4 5 5 1.5 5.45 5.85 0.203 0.214 0.23 L6 1.80 1.95 2.10 0.070 0.077 0.083 M 2.75 3.00 3.50 0.100 0.118 0.138 M2 5.61 0.95 0.40 0.086 0.88 M1 4.73 0.80 0.008 0.19 0.18 0.18 M2 0.561 0.009 0.009 P 3.20 3.30 3.80 0.126 0.138 0.15 R 1.170 0.086 P 3.20 0.039 N 2.20 0.086 P 3.30 0.009 R 1 0.50 0.002 V 5 6 (7bp) V2 20 (7bp) V3 45 (7bp) V1 3 (7bp) V2 20 (7bp) V3 45 (7bp) (1) dam-bar profusion not included; (2) molding profusion included	DIM.		mm		İ	inch		
B		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	OUTLINE AND
C								
D		1.80		2.00	0.070		0.079	MECHANICAL DATA
E 0.37 0.39 0.42 0.014 0.015 0.016 F(1) 0.057 0.002 G 0.80 1.00 1.20 0.031 0.040 0.047 G1 25.75 26.00 26.25 1.014 1.023 1.033 H1 17.00 0.669 H2 12.80 0.503 0.053 H3 0.80 2.40 0.852 0.888 0.883 L1 10.15 10.5 10.85 0.40 0.413 0.427 L(2) 21.64 22.04 22.44 0.852 0.888 0.883 L1 10.15 10.5 10.85 0.40 0.413 0.427 L2 (2) 15.50 15.70 15.90 0.610 0.618 0.626 L3 7.70 7.85 7.95 0.303 0.309 0.313 L4 5 5 10 0.070 0.077 0.083 M 2.75 3.00 3.50 0.108 0.118 0.138 M1 4.73 0.186 0.95 2.10 0.070 0.083 M 2.75 3.00 3.50 0.108 0.118 0.138 M1 4.73 0.0067 R1 0.50 0.0067 R1 0.50 0.002 R2 0.30 0.12 R3 1.25 0.049 R4 0.50 0.092 V1 3 (typ.) V2 20 (typ.) V3 45 (typ.) V1 3 (typ.) V2 20 (typ.) V3 45 (typ.) V1 3 (typ.) V2 20 (typ.) V3 45 (typ.) V1 3 (typ.) V2 20 (typ.) V3 45 (typ.) V1 3 (typ.) V2 20 (typ.) V3 45 (typ.) V1 3 (typ.) V2 20 (typ.) V3 45 (typ.) V1 3 (typ.) V2 20 (typ.) V3 45 (typ.) V1 3 (typ.) V2 20 (typ.) V3 45 (typ.) V1 3 (typ.) V2 20 (typ.) V3 45 (typ.) V1 3 (typ.) V2 20 (typ.) V3 45 (typ.)								
F (1)		0.37		0.42	0.014		0.016	
G1 25.75 26.00 26.25 1.014 1.023 1.033 1.033 1.125 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.153 1.150 1.151 1.1							0.022	
H 2 28.90 29.23 29.30 1.139 1.150 1.153 H1 1.700 0.668 1.153 H2 12.80 0.503 0.503 H3 1.155 10.85 0.40 0.413 0.427 1.2(2) 15.50 15.70 15.90 0.610 0.618 0.626 1.3 7.70 7.85 7.95 0.303 0.309 0.313 1.4 5 0.197 2.10 0.070 0.077 0.083 M 2.75 3.00 3.50 0.108 0.180 0.180 0.180 M1 4.73 0.186 M1 4.73 0.186 M2 5.61 0.220 N 2.20 0.30 0.180 0.158 0.158 M1 4.73 0.186 M2 5.61 0.020 N 2.20 0.006 N 2.20 N 2.20 0.006 N 2.20 0.006 N 2.20 N 2.20 0.006 N 2.20 N 2.20 0.006 N 2.20 N 2.20 N 2.20 0.006 N 2.20 N								
H1								
H2	H (2)	28.90	29.23	29.30	1.139	1.150	1.153	
H3								_
L(2) 21.64 22.04 22.44 0.852 0.868 0.883 L1 10.15 10.55 10.85 0.40 0.413 0.427 L(2) 15.50 15.70 15.90 0.610 0.618 0.628 L3 7.70 7.85 7.95 0.303 0.309 0.313 L4 5 0.0197 L5 5.15 5.45 5.85 0.203 0.214 0.23 M 2.75 3.00 3.50 0.108 0.118 0.138 M1 4.73 0.186 M2 5.61 0.0220 N 2.20 0.086 P 3.20 3.50 3.80 0.126 0.138 0.15 R 1 0.50 R1 0.50 N 2.20 0.006 R2 0.30 0.012 R3 1.25 0.0049 R4 0.50 V1 3 (Typ.) V2 20 (Typ.) V3 45 (Typ.) V2 20 (Typ.) V3 45 (Typ.) V1 3 (Typ.) V2 20 (Typ.) V3 45 (Typ.) V1 3 (Typ.) V2 20 (Typ.) V3 45 (Typ.) V4 5 (Typ.) V5 5 (Typ.) V6 5 (Typ.) V7 5 (Typ.) V8 5 (Typ.) V9 7 (Typ.) V9 7 (Typ.) V9 7 (Typ.) V9 8 (Typ.) V9 8 (Typ.) V9 9 (Typ.)								lacksquare
L1 10.15 10.5 10.85 0.40 0.413 0.427 L2 (2) 15.50 15.70 15.90 0.610 0.618 0.626 L3 7.70 7.85 7.95 0.303 0.309 0.313 L4 5 5.15 5.45 5.85 0.203 0.214 0.23 L6 1.80 1.95 2.10 0.070 0.077 0.083 M 2.75 3.00 3.50 0.108 0.118 0.138 M1 4.73 0.186 M2 5.61 0.220 N 220 0.086 P 3.20 3.50 3.80 0.126 0.138 0.15 R 1.70 0.050 0.02 R2 0.30 0.12 0.007 R1 0.50 0.02 R2 0.30 0.12 0.007 R1 0.50 0.002 R4 0.50 0.009 R4 0.50 0.009 R4 0.50 0.009 R4 0.50 0.009 R5 0.009 R6 0.009 R1 0.000 R7 0.000 R7 0.000 R8 0.000 R9 0.0000 R9 0.00		21 64		22 44	0.852		0.883	
12 (2) 15.50 15.70 15.90 0.610 0.618 0.626								
L4								
L6		7.70		7.95	0.303		0.313	
L6								
M								
M1								
M2		2.75		3.50	0.106		0.136	
N								
R								
R1		3.20		3.80	0.126		0.15	
R2								
R3								
R4 0.50 0.02 Flexiwatt27 (Horizontal) V 5 (Typ.) V2 20 (Typ.) V3 45 (Typ.) (1): dam-bar protusion not included; (2): molding protusion included		ļ						
V 5: (Typ.) V1 3' (Typ.) V2 20' (Typ.) V3 45' (Typ.) (1): dam-bar protusion not included; (2): molding protusion included								Eli
V1 3 (Typ.) V2 20 (Typ.) V3 45 (Typ.) (1): dam-bar protusion not included; (2): molding protusion included			0.00	5° (Typ.)	0.02	-	Flexiwatt2/
V2 20 (Typ.) (1): dam-bar protusion not included; (2): molding protusion included V	V1			3° (Typ.)			(Horizontal)
1): dam-bar protusion not included; (2): molding protusion included				20° ((Тур.)			(Honzontar)
	-							
	(1): dam-	bar protus	sion not ir	cluded; (2	2): moldin	g protusio	n included	
	27 27					H -		3/ V2
				G				

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TDA7850A Revision history

6 Revision history

Table 5. Document revision history

Date	Revision	Changes
09-Oct-2007	1	Initial release.
12-Sep-2008	2	Updated the values of V _{OS} and THD parameters on the <i>Table 4</i> .
07-Nov-2008	3	Modified max. values of the THD distortion in <i>Table 4: Electrical characteristics</i> on page 8.

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